WHAT IS CLAIMED IS:

1. A nucleic acid molecule comprising a nucleotide sequence encoding a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least the substitution T203X, wherein X is an aromatic amino acid selected from H, Y, W or F, said functional engineered fluorescent protein having a different fluorescent property than *Aequorea* green fluorescent protein.

2. The nucleic acid molecule of claim 1 wherein the amino acid sequence further comprises a substitution at S65, wherein the substitution is selected from S65G, S65T, S65A, S65L, S65C, S65V and S65I.

3. The nucleic acid molecule of claim 1 wherein the amino acid sequence differs by no more than the substitutions S65T/T203H; S65T/T203Y; S72A/F64L/S65G/T203Y; S72A/S65G/V68L/T203Y; S65G/V68L/Q69K/S72A/T203Y; S65G/S72A/T203Y; or S65G/S72A/T203W.

4. The nucleic acid molecule of claim 1 or 2 wherein the amino acid sequence further comprises a substitution at Y66, wherein the substitution is selected from Y66H, Y66F, and Y66W.

5. The nucleic acid molecule of claim 1 or 2 wherein the amino acid sequence further comprises a mutation from Table A.

6. The nucleic acid molecule of claim 1 or 2 wherein the amino acid sequence further comprises a folding mutation.

7. The nucleic acid molecule of any of claims 1-3 wherein the nucleotide sequence encoding the protein differs from the nucleotide sequence of SEQ ID NO:1 by the substitution of at least one codon by a preferred mammalian codon.

8. The nucleic acid molecule of any of claims 1-3 encoding a fusion protein wherein the fusion protein comprises a polypeptide of interest and the functional engineered fluorescent protein.

9. An expression vector comprising expression control sequences operatively linked to a nucleic acid molecule comprising a nucleotide sequence encoding a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least the amino acid substitution T203X, wherein X is an aromatic amino acid selected from H, Y, W or F, said functional engineered fluorescent protein having a different fluorescent property than *Aequorea* green fluorescent protein.

10. The expression vector of claim 9 wherein the amino acid sequence further comprises a substitution at S65, wherein the substitution is selected from S65G, S65T, S65A, S65L, S65C, S65V and S65I.

11. The expression vector of claim 9 wherein the amino acid sequence differs by no more than the substitutions S65T/T203H; S65T/T203Y; S72A/F64L/S65G/T203Y; S72A/S65G/V68L/T203Y; S65G/V68L/Q69K/S72A/T203Y, S65G/S72A/T203Y; or S65G/S72A/T203W.

12. The expression vector of claim 10 or 11 wherein the amino acid sequence further comprises a substitution at Y66, wherein the substitution is selected from Y66H, Y66F, and Y66W.

13. The expression vector of claim 10 or 11 wherein the amino acid sequence further comprises a mutation from Table A.

14. The expression vector of claim 9 or 10 wherein the amino acid sequence further comprises a folding mutation.

15. The expression vector of any of claims 9-11 wherein the nucleotide sequence encoding the protein differs from the nucleotide sequence of SEQ ID NO:1 by the substitution of at least one codon by a preferred mammalian codon.

16. The expression vector of any of claims 9-11 encoding a fusion protein wherein the fusion protein comprises a polypeptide of interest and the functional engineered fluorescent protein.

17. A recombinant host cell comprising an expression vector that comprises expression control sequences operatively linked to a nucleic acid molecule comprising a nucleotide sequence encoding a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least the amino acid substitution T203X, wherein X is an aromatic amino acid selected from H, Y, W or F, said functional engineered fluorescent protein having a different fluorescent property than *Aequorea* green fluorescent protein.

18. The recombinant host cell of claim 17 wherein the amino acid sequence further comprises a substitution at S65, wherein the substitution is selected from S65G, S65T, S65A, S65L, S65C, S65V and S65I.

19. The recombinant host cell of claim 17 wherein the amino acid sequence differs by no more than the substitutions S65T/T203H; S65T/T203Y; S72A/F64L/S65G/T203Y; S72A/S65G/V68L/T203Y; S65G/V68L/Q69K/S72A/T203Y; S65G/S72A/T203Y; or S65G/S72A/T203W.

20. The recombinant host cell of claim 17 or 18 wherein the amino acid sequence further comprises a substitution at Y66, wherein the substitution is selected from Y66H, Y66F, and Y66W.

21. The recombinant host cell of claim 17 or 18 wherein the amino acid sequence further comprises a mutation from Table A.

22. The recombinant host cell of claim 17 or 18 wherein the amino acid sequence further comprises a folding mutation.

23. The recombinant host cell of any of claims 17-19 wherein the nucleotide sequence encoding the protein differs from the nucleotide sequence of SEQ ID NO:1 by the substitution of at least one codon by a preferred mammalian codon.

24. The recombinant host cell of any of claims 17-19 encoding a fusion protein wherein the fusion protein comprises a polypeptide of interest and the functional engineered fluorescent protein.

25. The recombinant host cell of any of claims 17-19 which is a prokaryotic cell.

26. The recombinant host cell of any of claims 17-19 which is a eukaryotic cell.

27. A functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least the amino acid substitution T203X, wherein X is an aromatic amino acid selected from H, Y, W or F, said functional engineered fluorescent protein having a different fluorescent property than *Aequorea* green fluorescent protein.

28. The protein of claim 27 wherein the amino acid sequence further comprises a substitution at S65, wherein the substitution is selected from S65G, S65T, S65A, S65L, S65C, S65V and S65I.

29. The protein of claim 27 wherein the amino acid sequence differs by nō more than the substitutions S65T/T203H; S65T/T203Y; S72A/F64L/S65G/T203Y; S72A/S65G/V68L/T203Y; S65G/V68L/Q69K/S72A/T203Y; S65G/S72A/T203Y; or S65G/S72A/T203W.

30. The protein of claim 27 or 28 wherein the amino acid sequence further comprises a substitution at Y66, wherein the substitution is selected from Y66H, Y66F, and Y66W.

31. The protein of claim 27 or 28 wherein the amino acid sequence further comprises a folding mutation.

32. The protein of any of claims 27-29 which is a fusion protein wherein the fusion protein comprises a polypeptide of interest and the functional engineered fluorescent protein.

33. A fluorescently labelled antibody comprising an antibody coupled to a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least the amino acid substitution T203X, wherein X is an aromatic amino acid selected from H, Y, W or F, said functional engineered fluorescent protein having a different fluorescent property than *Aequorea* green fluorescent protein.

34. The fluorescently labelled antibody of claim 33 wherein the amino acid sequence further comprises a substitution at S65, wherein the substitution is selected from S65G, S65T, S65A, S65L, S65C, S65V and S65I.

35. The fluorescently labelled antibody of claim 33 wherein the amino acid sequence differs by no more than the substitutions S65T/T203H; S65T/T203Y; S72A/F64L/S65G/T203Y; S72A/S65G/V68L/T203Y; S65G/V68L/Q69K/S72A/T203Y; S65G/S72A/T203Y; or S65G/S72A/T203W.

36. The fluorescently labelled antibody of claim 33 or 34 wherein the amino acid sequence further comprises a substitution at Y66, wherein the substitution is selected from Y66H, Y66F, and Y66W.

37. The fluorescently labelled antibody of any of claims 33-35 which is a fusion protein wherein the fusion protein comprises the antibody fused to the functional engineered fluorescent protein.

38. A nucleic acid molecule comprising a nucleotide sequence encoding an antibody fused to a nucleotide sequence encoding a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least the amino acid substitution T203X, wherein X is an aromatic amino acid selected from H, Y, W or F, said functional engineered fluorescent protein having a different fluorescent property than *Aequorea* green fluorescent protein.

39. The nucleic acid molecule of claim 38 wherein the amino acid sequence further comprises a substitution at S65, wherein the substitution is selected from S65G, S65T, S65A, S65L, S65C, S65V and S65I.

40. The nucleic acid molecule of claim 38 wherein the amino acid sequence differs by no more than the substitutions S65T/T203H; S65T/T203Y; S72A/F64L/S65G/T203Y; S72A/S65G/V68L/T203Y; S65G/V68L/Q69K/S72A/T203Y; S65G/S72A/T203Y; or S65G/S72A/T203W.

41. The nucleic acid molecule of claim 38 or 39 wherein the amino acid sequence further comprises a substitution at Y66, wherein the substitution is selected from Y66H, Y66F, and Y66W.

42. A fluorescently labelled nucleic acid probe comprising a nucleic acid probe coupled to a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least the amino acid substitution T203X, wherein X is an aromatic amino acid selected from H, Y, W or F, said functional engineered fluorescent protein having a different fluorescent property than *Aequorea* green fluorescent protein.

43. The fluorescently labelled nucleic acid probe of claim 42 wherein the amino acid sequence further comprises a substitution at S65, wherein the substitution is selected from S65G, S65T, S65A, S65L, S65C, S65V and S65I.

44. The fluorescently labelled nucleic acid probe of claim 42 wherein the amino acid sequence differs by no more than the substitutions S65T/T203H; S65T/T203Y; S72A/F64L/S65G/T203Y; S72A/S65G/V68L/T203Y; S65G/V68L/Q69K/S72A/T203Y; S65G/S72A/T203Y; or S65G/S72A/T203W.

45. The nucleic acid molecule of claim 42 or 43 wherein the amino acid sequence further comprises a substitution at Y66, wherein the substitution is selected from Y66H, Y66F, and Y66W.

46. A nucleic acid molecule comprising a nucleotide sequence encoding a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least an amino acid substitution at L42, V61, T62, V68, Q69, Q94, N121, Y145, H148, V150, F165, I167, Q183, N185, L220, E222 (not E222G), or V224, said functional engineered fluorescent protein having a different fluorescent property than *Aequorea* green fluorescent protein.

47. The nucleic acid molecule of claim 46 wherein the amino acid substitution is:

L42X, wherein X is selected from C, F, H, W and Y,

V61X, wherein X is selected from F, Y, H and C,

T62X, wherein X is selected from A, V, F, S, D, N, Q, Y, H and C,

V68X, wherein X is selected from F, Y and H,

Q69X, wherein X is selected from K, R, E and G,

Q94X, wherein X is selected from D, E, H, K and N,

N121X, wherein X is selected from F, H, W and Y,

Y145X, wherein X is selected from W, C, F, L, E, H, K and Q,

H148X, wherein X is selected from F, Y, N, K, Q and R,

V150X, wherein X is selected from F, Y and H,

F165X, wherein X is selected from H, Q, W and Y,

I167X, wherein X is selected from F, Y and H,

Q183X, wherein X is selected from H, Y, E and K,

N185X, wherein X is selected from D, E, H, K and Q,

L220X, wherein X is selected from H, N, Q and T,

E222X, wherein X is selected from N and Q or

V224X, wherein X is selected from H, N, Q, T, F, W and Y.

48. An expression vector comprising expression control sequences operatively linked to a nucleic acid molecule of comprising a nucleotide sequence encoding a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least an amino acid substitution at L42, V61, T62, V68, Q69, Q94, N121, Y145, H148, V150, F165, I167, Q183, N185, L220, E222 (not E222G), or V224, said functional engineered fluorescent protein having a different fluorescent property than *Aequorea* green fluorescent protein.

49. The expression vector of claim 48 wherein the amino acid substitution is:

L42X, wherein X is selected from C, F, H, W and Y,

V61X, wherein X is selected from F, Y, H and C,

T62X, wherein X is selected from A, V, F, S, D, N, Q, Y, H and C,

V68X, wherein X is selected from F, Y and H,

Q69X, wherein X is selected from K, R, E and G,

Q94X, wherein X is selected from D, E, H, K and N,

N121X, wherein X is selected from F, H, W and Y,

Y145X, wherein X is selected from W, C, F, L, E, H, K and Q,

H148X, wherein X is selected from F, Y, N, K, Q and R,

V150X, wherein X is selected from F, Y and H,

F165X, wherein X is selected from H, Q, W and Y,

I167X, wherein X is selected from F, Y and H,

Q183X, wherein X is selected from H, Y, E and K,

N185X, wherein X is selected from D, E, H, K and Q,

L220X, wherein X is selected from H, N, Q and T,

E222X, wherein X is selected from N and Q or

V224X, wherein X is selected from H, N, Q, T, F, W and Y.

50. A recombinant host cell comprising an expression vector that comprises expression control sequences operatively linked to a nucleic acid molecule comprising a nucleotide sequence encoding a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least an amino acid substitution at L42, V61, T62, V68, Q69, Q94, N121, Y145, H148, V150, F165, I167, Q183, N185, L220, E222 (not E222G), or V224, said functional engineered fluorescent protein having a different fluorescent property than *Aequorea* green fluorescent protein.

51. The recombinant host cell of claim 50 wherein the amino acid substitution is:

L42X, wherein X is selected from C, F, H, W and Y,

V61X, wherein X is selected from F, Y, H and C,

T62X, wherein X is selected from A, V, F, S, D, N, Q, Y, H and C,

V68X, wherein X is selected from F, Y and H,

Q69X, wherein X is selected from K, R, E and G,

Q94X, wherein X is selected from D, E, H, K and N,

N121X, wherein X is selected from F, H, W and Y,

Y145X, wherein X is selected from W, C, F, L, E, H, K and Q,

H148X, wherein X is selected from F, Y, N, K, Q and R,

V150X, wherein X is selected from F, Y and H,

F165X, wherein X is selected from H, Q, W and Y,

I167X, wherein X is selected from F, Y and H,

Q183X, wherein X is selected from H, Y, E and K,

N185X, wherein X is selected from D, E, H, K and Q,

L220X, wherein X is selected from H, N, Q and T,

E222X, wherein X is selected from N and Q or

V224X, wherein X is selected from H, N, Q, T, F, W and Y.

52. A functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least an amino acid substitution at L42, V61, T62, V68, Q69, Q94, N121, Y145, H148, V150, F165, I167, Q183, N185, L220, E222 (E222G), or V224, said functional engineered fluorescent protein having a different fluorescent property than *Aequorea* green fluorescent protein.

53. The functional engineered fluorescent protein of claim 52 wherein the amino acid substitution is:

L42X, wherein X is selected from C, F, H, W and Y,

V61X, wherein X is selected from F, Y, H and C,

T62X, wherein X is selected from A, V, F, S, D, N, Q, Y, H and C,

V68X, wherein X is selected from F, Y and H,

Q69X, wherein X is selected from K, R, E and G,

Q94X, wherein X is selected from D, E, H, K and N,

N121X, wherein X is selected from F, H, W and Y,

Y145X, wherein X is selected from W, C, F, L, E, H, K and Q,

H148X, wherein X is selected from F, Y, N, K, Q and R,

V150X, wherein X is selected from F, Y and H,

F165X, wherein X is selected from H, Q, W and Y,

I167X, wherein X is selected from F, Y and H,

Q183X, wherein X is selected from H, Y, E and K,

N185X, wherein X is selected from D, E, H, K and Q,

L220X, wherein X is selected from H, N, Q and T,

E222X, wherein X is selected from N and Q or

V224X, wherein X is selected from H, N, Q, T, F, W and Y.

54. A fluorescently labelled antibody comprising an antibody coupled to a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least an amino acid substitution at L42, V61, T62, V68, Q69, Q94, N121, Y145, H148, V150, F165, I167, Q183, N185, L220, E222 (not E222G), or V224, said functional engineered fluorescent protein having a different fluorescent property than *Aequorea* green fluorescent protein.

55. The antibody of claim 54 wherein the amino acid substitution is:

L42X, wherein X is selected from C, F, H, W and Y,

V61X, wherein X is selected from F, Y, H and C,

T62X, wherein X is selected from A, V, F, S, D, N, Q, Y, H and C,

V68X, wherein X is selected from F, Y and H,

Q69X, wherein X is selected from K, R, E and G,

Q94X, wherein X is selected from D, E, H, K and N,

N121X, wherein X is selected from F, H, W and Y,

Y145X, wherein X is selected from W, C, F, L, E, H, K and Q,

H148X, wherein X is selected from F, Y, N, K, Q and R,

V150X, wherein X is selected from F, Y and H,

F165X, wherein X is selected from H, Q, W and Y,

I167X, wherein X is selected from F, Y and H,

Q183X, wherein X is selected from H, Y, E and K,

N185X, wherein X is selected from D, E, H, K and Q,

L220X, wherein X is selected from H, N, Q and T,

E222X, wherein X is selected from N and Q or

V224X, wherein X is selected from H, N, Q, T, F, W and Y.

56. A nucleic acid molecule comprising a nucleotide sequence encoding an antibody fused to a nucleotide sequence encoding a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least an amino acid substitution at L42, V61, T62, V68, Q69, Q94, N121, Y145, H148, V150, F165, I167, Q183, N185, L220, E222 (not E222G), or V224, said functional engineered fluorescent protein having a different fluorescent property than *Aequorea* green fluorescent protein.

57. The nucleic acid molecule of claim 56 wherein the amino acid substitution is:

L42X, wherein X is selected from C, F, H, W and Y,

V61X, wherein X is selected from F, Y, H and C,

T62X, wherein X is selected from A, V, F, S, D, N, Q, Y, H and C,

V68X, wherein X is selected from F, Y and H,

Q69X, wherein X is selected from K, R, E and G,

Q94X, wherein X is selected from D, E, H, K and N,

N121X, wherein X is selected from F, H, W and Y,

Y145X, wherein X is selected from W, C, F, L, E, H, K and Q,

H148X, wherein X is selected from F, Y, N, K, Q and R,

V150X, wherein X is selected from F, Y and H,

F165X, wherein X is selected from H, Q, W and Y,

I167X, wherein X is selected from F, Y and H,

Q183X, wherein X is selected from H, Y, E and K,

N185X, wherein X is selected from D, E, H, K and Q,

L220X, wherein X is selected from H, N, Q and T,

E222X, wherein X is selected from N and Q or

V224X, wherein X is selected from H, N, Q, T, F, W and Y.

58. A fluorescently labelled nucleic acid probe comprising a nucleic acid probe coupled to a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least an amino acid substitution at L42, V61, T62, V68, Q69, Q94, N121, Y145, H148, V150, F165, I167, Q183, N185, L220, E222 (E222G), or V224, said functional engineered fluorescent protein having a different fluorescent property than *Aequorea* green fluorescent protein.

59. The probe of claim 58 wherein the amino acid substitution is:

L42X, wherein X is selected from C, F, H, W and Y,

V61X, wherein X is selected from F, Y, H and C,

T62X, wherein X is selected from A, V, F, S, D, N, Q, Y, H and C,

V68X, wherein X is selected from F, Y and H,

Q69X, wherein X is selected from K, R, E and G,

Q94X, wherein X is selected from D, E, H, K and N,

N121X, wherein X is selected from F, H, W and Y,

Y145X, wherein X is selected from W, C, F, L, E, H, K and Q,

H148X, wherein X is selected from F, Y, N, K, Q and R,

V150X, wherein X is selected from F, Y and H,

F165X, wherein X is selected from H, Q, W and Y,

I167X, wherein X is selected from F, Y and H,

Q183X, wherein X is selected from H, Y, E and K,

N185X, wherein X is selected from D, E, H, K and Q,

L220X, wherein X is selected from H, N, Q and T,

E222X, wherein X is selected from N and Q or

V224X, wherein X is selected from H, N, Q, T, F, W and Y.

60. A method for determining whether a mixture contains a target comprising:

contacting the mixture with a fluorescently labelled probe comprising a probe and a functional engineered fluorescent protein of claim 27 or claim 52; and

determining whether the target has bound to the probe.

61. The method of any of claim 60 the target is bound to a solid matrix.

62. A method for engineering a functional engineered fluorescent protein having a fluorescent property different than *Aequorea* green fluorescent protein, comprising substituting an amino acid that is located no more than 0.5 nm from any atom in the chromophore of an *Aequorea*-related green fluorescent protein with another amino acid; whereby the substitution alters a fluorescent property of the protein.

63. The method of claim 62 wherein the amino acid substitution alters the electronic environment of the chromophore.

64. A method for engineering a functional engineered fluorescent protein having a different fluorescent property than *Aequorea* green fluorescent protein comprising substituting amino acids in a loop domain of an *Aequorea*-related green fluorescent protein with amino acids so as to create a consensus sequence for phosphorylation or for proteolysis.

65. A method for producing fluorescence resonance energy transfer comprising:

providing a donor molecule comprising a functional engineered fluorescent protein of claim 27 or claim 52;

providing an appropriate acceptor molecule for the fluorescent protein; and

bringing the donor molecule and the acceptor molecule into sufficiently close contact to allow fluorescence resonance energy transfer.

66. A method for producing fluorescence resonance energy transfer comprising:

providing an acceptor molecule comprising a functional engineered fluorescent protein of claim 27 or claim 52;

providing an appropriate donor molecule for the fluorescent protein; and

bringing the donor molecule and the acceptor molecule into sufficiently close contact to allow fluorescence resonance energy transfer.

67. The method of claim 66 wherein the donor molecule is a engineered fluorescent protein whose amino acid sequence comprises the substitution T203I and the acceptor molecule is a mutant fluorescent protein whose amino acid sequence comprises the substitution T203X, wherein X is an aromatic amino acid selected from H, Y, W or F, said functional engineered fluorescent protein having a different fluorescent property than *Aequorea* green fluorescent protein.

68. A nucleic acid molecule comprising a nucleotide sequence encoding a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least an amino acid substitution located no more than about 0.5 nm from the chromophore of the engineered fluorescent protein, wherein the substitution alters the electronic environment of the chromophore, whereby the functional engineered fluorescent protein has a different fluorescent property than *Aequorea* green fluorescent protein.

69. An expression vector comprising expression control sequences operatively linked to a nucleotide sequence encoding a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least an amino acid substitution located no more than about 0.5 nm from the chromophore of the engineered fluorescent protein, wherein the substitution alters the electronic environment of the chromophore, whereby the functional engineered fluorescent protein has a different fluorescent property than *Aequorea* green fluorescent protein.

70. A functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least an amino acid substitution located no more than about 0.5 nm from the chromophore of the engineered fluorescent protein, wherein the substitution alters the electronic environment of the chromophore, whereby the functional engineered fluorescent protein has a different fluorescent property than *Aequorea* green fluorescent protein.

71. A crystal of a protein comprising a fluorescent protein with an amino acid sequence substantially identical to SEQ ID NO: 2, wherein said crystal diffracts with at least a 2.0 to 3.0 angstrom resolution.

72. The crystal of claim 71, wherein the fluorescent protein has at least 200 amino acids, a completeness value of at least 80% and has a crystal stability within 0.5% of its unit cell dimensions.

73. The crystal of claim 71, wherein the amino acid sequence comprises a substitution at S65, wherein the substitution is selected from S65G, S65T, S65A, S65L, S65C, S65V and S65I.

74. The crystal of claim 71, wherein said crystal has the following unit cell dimensions in angstroms: a = 51.8, b= 62.8 and c= 70.7 with a space group of P2 2 2 and an α angle of 90.00°, a β angle of 90.00° and a γ angle of 90.00° and the crystal has a diffraction limit where 90% or greater of the potential reflections can be used to determine the coordinates of the atoms.

75. A computational method of designing a fluorescent protein comprising:

determining from a three dimensional model of a crystallized fluorescent protein comprising a fluorescent protein with a bound ligand, at least one interacting amino acid of the fluorescent protein that interacts with at least one first chemical moiety of the ligand, and

selecting at least one chemical modification of the first chemical moiety to produce a second chemical moiety with a structure to either decrease or increase an interaction between the interacting amino acid and the second chemical moiety compared to the interaction between the interacting amino acid and the first chemical moiety.

76. The computational method of claim 75, further comprising generating the three dimensional model of the crystallized protein comprising a fluorescent protein with an amino acid sequence substantially identical to SEQ ID NO:2.

77. The computational method of claim 75, wherein the selecting selects the first chemical moiety that interacts with at least one of the amino acids listed in Figs. 5-1 to 5-28.

78. The computational method of claim 75, wherein the chemical modification enhances hydrogen bonding interaction, charge interaction, hydrophobic interaction, Van Der Waals interaction or dipole interaction between the second chemical moiety and the interacting amino acid compared to the first chemical moiety and the interacting amino acid.

79. A computational method of modeling the three dimensional structure of a fluorescent protein comprising determining a three dimensional relationship between at least two atoms listed in the atomic coordinates of Figs. 5-1 to 5-28.

80. The computational method of claim 79, wherein the determining comprises determining the three dimensional structure of a fluorescent protein with an amino acid sequence at least 80% identical to SEQ ID NO:2.

81. The computational method of claim 79, wherein the determining comprises determining the three dimensional structure of a fluorescent protein with an amino acid sequence at least 95% identical to SEQ ID NO:2.

82. The computational method of claim 79, wherein the determining comprises determining the three dimensional relationship of at least 1500 atoms listed in Figs. 5-1 to 5-28.

83. A device comprising a storage device and, stored in the device, at least 10 atomic coordinates selected from the atomic coordinates listed in Figs. 5-1 to 5-28.

84. The device of claim 83, wherein the storage device is a computer readable device that stores code that receives as input the atomic coordinates.

85. The device of claim 84, wherein computer readable device is a floppy disk or a hard drive.

86. A nucleic acid molecule comprising a nucleotide sequence encoding a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least a substitution at Q69, wherein said functional engineered fluorescent protein has a different fluorescent property than *Aequorea* green fluorescent protein.

87. The nucleic acid molecule of claim 86, wherein said substitution at Q69 is selected from the group of K, R, E and G.

88. The nucleic acid molecule of claim 86, wherein said amino acid sequence further comprises a function mutation at S65.

89. A nucleic acid molecule comprising a nucleotide sequence encoding a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least a substitution at E222, but not including E222G, wherein said functional engineered fluorescent protein has a different fluorescent property than *Aequorea* green fluorescent protein.

90. The nucleic acid molecule of claim 89, wherein said substitution at E222 is selected from the group of N and Q.

91. The nucleic acid molecule of claim 89, wherein said amino acid sequence further comprises a function mutation at F64.

92. A nucleic acid molecule comprising a nucleotide sequence encoding a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least a substitution at Y145, wherein said functional engineered fluorescent protein has a different fluorescent property than *Aequorea* green fluorescent protein.

93. The nucleic acid molecule of claim 92, wherein said substitution at Y145 is selected from the group of W, C, F, L, E, H, K and Q.

94. The nucleic acid molecule of claim 92, wherein said amino acid sequence further comprises a function mutation at Y66.

95. A method of identifying a test chemical, comprising:

contacting a test chemical a sample containing a biological entity labeled with a functional, engineered fluorescent protein or a polynucleotide encoding said functional, engineered fluorescent protein, and

detecting fluorescence of said functional engineered fluorescent protein.

96. The method of claim 95, wherein said fluorescence in the presence of a test chemical is greater than in the absence of said test chemical.

97. The method of claim 96, wherein said polynucleotide encoding said functional, engineered fluorescent protein is operatively linked to a genomic polynucleotide.

98. The method of claim 95, wherein said functional, engineered fluorescent protein is fused to second functional protein.

99. The method of claim 96, wherein said polynucleotide encoding said functional, engineered fluorescent protein is operatively linked to a response element.

100. The method of claim 96, wherein said polynucleotide encoding said functional, engineered fluorescent protein is operatively linked to a response element in a mammalian cell.

101. A nucleic acid molecule comprising a nucleotide sequence encoding a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by

i) at least one first substitution at position T203, wherein the substitution selected from the group consisting H, Y, W or F, and

ii) at least one second substitution at position H148,

wherein said functional engineered fluorescent protein has a different fluorescent property than *Aequorea* green fluorescent protein.

102. The nucleic acid molecule of claim 101, wherein said at least one second substitution at position H148 is selected from the group consisting of H148R, H148G, H148Q, H148A, H148N, and H148K.

103. The nucleic acid of claim 101, wherein said at least one second substitution at position H148 is H148Q.

104. The nucleic acid of claim 101, wherein said at least one second substitution at position H148 is H148G.

105. The nucleic acid of claim 101, wherein said at least one second substitution at position H148 is H148R.

106. The nucleic acid of claim 101, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position V150.

107. The nucleic acid of claim 106, wherein said at least one third substitution at position V150 is selected from the group consisting of A, C, M, G, L, Q, S, T and N.

108. The nucleic acid of claim 101, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position V163.

109. The nucleic acid of claim 108, wherein said at least one third substitution at position V163 is selected from the group consisting of A, C, M, G, L, Q, S, T and N.

110. The nucleic acid of claim 101, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position Q69.

111. The nucleic acid of claim 110, wherein said at least one third substitution at position Q69 is selected from the group consisting of N, S, T and V.

112. The nucleic acid of claim 101, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position V152.

113. The nucleic acid of claim 112, wherein said at least one third substitution at position V152 is selected from the group consisting of A, C, M, G, L, V, F, S, T, Q and N.

114. The nucleic acid of claim 101, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position F165.

115. The nucleic acid of claim 114, wherein said at least one third substitution at position F165 is selected from the group consisting of Y, L and W.

116. The nucleic acid of claim 101, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position H181.

117. The nucleic acid of claim 116, wherein said at least one third substitution at position H181 is selected from the group consisting of K, R, F, Y and W.

118. The nucleic acid of claim 101, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position L201.

119. The nucleic acid of claim 118, wherein said at least one third substitution at position L201 is selected from the group consisting of A, C, M, G, S, T ,Q, N, V and I.

120. A method of determining the presence of an anion of interest in a sample, comprising the steps of,

1) introducing an engineered green fluorescent protein into a sample, said engineered green fluorescent protein comprising an amino acid sequence substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least one first substitution at position T203, wherein the substitution selected from the group consisting H, Y, W or F,

2) determining the fluorescence of said engineered green fluorescent protein in said sample.

121. The method of claim 120, further comprising the step of comparing the fluorescence of said engineered green fluorescent protein in said sample to the fluorescence of a control engineered green fluorescent protein introduced into a control sample comprising said anion of interest at a known concentration.

122. The method of claim 120, wherein said sample comprises at least one living cell.

123. The method of claim 120, wherein said anion of interest is a halide.

124. The method of claim 120, wherein said engineered fluorescent protein comprises at least one second substitution at position H148.

125. The method of claim 124, wherein, wherein said at least one second substitution at position H148 is selected from the group consisting of H148R. H148G, H148Q, H148A, H148N, and H148K.

126. The method of claim 125, wherein, wherein said at least one second substitution at position H148 is H148Q.

127. The method of claim 125, wherein, wherein said at least one second substitution at position H148 is H148G.

128. The method of claim 125, wherein, wherein said at least one second substitution at position H148 is H148R.

129. The method of claim 120, wherein, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position V150.

130. The method of claim 129, wherein, wherein said at least one third substitution at position V150 is selected from the group consisting of A, C, M, G, L, Q, S, T and N.

131. The method of claim 120, wherein, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position V163.

132. The method of claim 131, wherein, wherein said at least one third substitution at position V163 is selected from the group consisting of Q, S, T and N.

133. The method of claim 120, wherein, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position Q69.

134. The method of claim 133, wherein, wherein said at least one third substitution at position Q69 is selected from the group consisting of N, S, T and V.

135. The method of claim 120, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position V152.

136. The method of claim 135, wherein said at least one third substitution at position V152 is selected from the group consisting of A, C, M, G, L, V, F, S, T, Q and N.

137. The method of claim 120, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position F165.

138. The method of claim 137, wherein said at least one third substitution at position F165 is selected from the group consisting of Y, L and W.

139. The method of claim 120, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position H181.

140. The method of claim 139, wherein said at least one third substitution at position H181 is selected from the group consisting of K, R, F, Y and W.

141. The method of claim 120, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position L201.

142. The method of claim 141, wherein said at least one third substitution at position L201 is selected from the group consisting of A, C, M, G, S, T ,Q, N, V and I.

143. A functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by

i) at least one first substitution at position T203, wherein the substitution selected from the group consisting H, Y, W or F, and

ii) at least one second substitution at position H148,

wherein said functional engineered fluorescent protein has a different fluorescent property than *Aequorea* green fluorescent protein.

144. The functional engineered fluorescent protein of claim 143, wherein said at least one second substitution at position H148 is selected from the group consisting of H148R, H148G, H148Q, H148A, H148N, and H148K.

145. The functional engineered fluorescent protein of claim 144, wherein said at least one second substitution at position H148 is H148Q.

146. The functional engineered fluorescent protein of claim 144, wherein said at least one second substitution at position H148 is H148G.

147. The functional engineered fluorescent protein of claim 144, wherein said at least one second substitution at position H148 is H148R.

148. The functional engineered fluorescent protein of claim 143, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position V150.

149. The functional engineered fluorescent protein of claim 148, wherein said at least one third substitution at position V150 is selected from the group consisting of Q, S, T and N.

150. The functional engineered fluorescent protein of claim 143, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position V163.

151. The functional engineered fluorescent protein of claim 150, wherein said at least one third substitution at position V163 is selected from the group consisting of Q, S, T and N.

152. The functional engineered fluorescent protein of claim 143, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position Q69.

153. The functional engineered fluorescent protein of claim 152, wherein said at least one third substitution at position Q69 is selected from the group consisting of N, S, T and V.

154. A host cell comprising a functional engineered fluorescent protein whose amino acid sequence is substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by

i) at least one first substitution at position T203, wherein the substitution selected from the group consisting H, Y, W or F, and

ii) at least one second substitution at position H148,

wherein said functional engineered fluorescent protein has a different fluorescent property than *Aequorea* green fluorescent protein.

155. The host cell of claim 154, wherein said at least one second substitution at position H148 is selected from the group consisting of H148R, H148G, H148Q, H148A, H148N, and H148K.

156. The host cell of claim 155, wherein said at least one second substitution at position H148 is H148Q.

157. The host cell of claim 155, wherein said at least one second substitution at position H148 is H148G.

158. The host cell of claim 155, wherein said at least one second substitution at position H148 is H148R.

159. The host cell of claim 143, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position V150.

160. The host cell of claim 159, wherein said at least one third substitution at position V150 is selected from the group consisting of Q, S, T and N.

161. The host cell of claim 143, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position V163.

162. The host cell of claim 161, wherein said at least one third substitution at position V163 is selected from the group consisting of Q, S, T and N.

163. The host cell of claim 143, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position Q69.

164. The host cell of claim 163, wherein said at least one third substitution at position Q69 is selected from the group consisting of N, S, T and V.

165. A method for screening the effects of test compounds on ion channel activity comprising the steps of,

i) providing a cell comprising

a) an engineered green fluorescent protein said engineered green fluorescent protein comprising an amino acid sequence substantially identical to the amino acid sequence of *Aequorea* green fluorescent protein (SEQ ID NO:2) and which differs from SEQ ID NO:2 by at least one first substitution at position T203, wherein the substitution selected from the group consisting H, Y, W or F,

b) an ion channel of interest,

ii) contacting said cell with a test compound,

iii) determining fluorescence from said engineered green fluorescent protein.

166. The method of claim 165 wherein said method further comprises the step of contacting said cell with a known activator of said ion channel of interest.

167. The method of claim 165, further comprising the step of comparing the fluorescence of said engineered green fluorescent protein in said cell to the fluorescence of a control engineered green fluorescent protein introduced into a control cell..

168. The method of claim 165, wherein said ion channel of interest transports halides.

169. The method of claim 165, wherein said engineered fluorescent protein comprises at least one second substitution at position H148.

170. The method of claim 169, wherein, wherein said at least one second substitution at position H148 is selected from the group consisting of H148R. H148G, H148Q, H148A, H148N, and H148K.

171. The method of claim 170, wherein, wherein said at least one second substitution at position H148 is H148Q.

172. The method of claim 170, wherein, wherein said at least one second substitution at position H148 is H148G.

173. The method of claim 170, wherein, wherein said at least one second substitution at position H148 is H148R.

174. The method of claim 165, wherein, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position V150.

175. The method of claim 174, wherein, wherein said at least one third substitution at position V150 is selected from the group consisting of A, C, M, G, L, Q, S, T and N.

176. The method of claim 165, wherein, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position V163.

177. The method of claim 176, wherein, wherein said at least one third substitution at position V163 is selected from the group consisting of Q, S, T and N.

178. The method of claim 165, wherein, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position Q69.

179. The method of claim 178, wherein, wherein said at least one third substitution at position Q69 is selected from the group consisting of N, S, T and V.

180. The method of claim 165, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position V152.

181. The method of claim 180, wherein said at least one third substitution at position V152 is selected from the group consisting of A, C, M, G, L, V, F, S, T, Q and N.

182. The method of claim 165, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position F165.

183. The method of claim 182, wherein said at least one third substitution at position F165 is selected from the group consisting of Y, L and W.

184. The method of claim 165, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position H181.

185. The method of claim 184, wherein said at least one third substitution at position H181 is selected from the group consisting of K, R, F, Y and W.

186. The method of claim 165, wherein said functional engineered fluorescent protein further comprises at least one third substitution at position L201.

187. The method of claim 186, wherein said at least one third substitution at position L201 is selected from the group consisting of A, C, M, G, S, T ,Q, N, V and I.